

The relative effectiveness of fixed-wing aircraft and helicopters for surveying Trumpeter Swans

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Abstract

The effectiveness of fixed-wing aircraft and helicopters for surveying Trumpeter Swans *Cygnus buccinator* is compared. The helicopter survey yielded 70% more adults and 44% more cygnets than the fixed-wing aircraft survey. The additional adults observed during the helicopter survey included two pairs, a single bird, and a pair with four cygnets. All broods observed during both surveys were undercounted by one cygnet during the fixed-wing aircraft survey. The lower flight speed and greater manoeuvrability of helicopters are obvious assets during aerial surveys.

Introduction

Fixed-wing aircraft have been used in wildlife management for over 40 years (Crissey 1954). Their range and relatively inexpensive operation have allowed biologists access to otherwise inaccessible locations. Accordingly, they have been an indispensable tool for population surveys (Lotter and Cornwell 1969). However, their flight characteristics (e.g., relatively high cruising speed, minimum flight height, limited manoeuvrability) limit their effectiveness. Caughley *et al.* (1976) concluded that the ability to sight animals on the ground during aerial surveys decreases with increasing speed, height above ground, and transect width. As a result, fixed-wing aircraft surveys are complicated by detectability biases (Diem and Lu 1960; Martinsen and Kaczynski 1974) and generally underestimate animal numbers (Caughley 1974). Biologists have increasingly turned to helicopters in response to these constraints (Kaminski 1979; DeYoung 1985; Ross 1985). Ross (1985) concluded that helicopter surveys of waterfowl produced results similar to those from ground searches. Helicopters offer the advantages of slower cruising speed, variable flight heights, and greatly increased manoeuvrability. These advantages, however, are offset by their limited range and greater operating costs (Thompson and Baker 1981).

Although most Trumpeter Swan *Cygnus buccinator* population surveys have been conducted in fixed-wing aircraft (King 1973; McCormick and Shandruk 1986, 1987), helicopters have been used occasionally for localized surveys or other work (Shandruk and McCormick 1988). In July–August 1986, we surveyed an area with both a fixed-wing aircraft and a helicopter. The purpose of this paper is to present our results

and to discuss their implications for future Trumpeter Swan surveys.

Study area

The study area is situated in the vicinity of Nahanni Butte, in the southwest portion of the Mackenzie District, Northwest Territories. It includes the wetlands adjacent to the Liard–South Nahanni rivers junction and along Fishtrap Creek and Tetcela River (Fig. 1). The wetlands occur on silt-clay flood plains that border the rivers and creeks. These recent alluvial soils support forests of white spruce *Picea glauca* and balsam poplar *Populus balsamifera* in mixed or pure stands. The shrub layer consists of alder *Alnus incana*, squashberry *Viburnum edule*, and wild rose *Rosa acicularis*. Emergent vegetation is composed of cattail *Typha latifolia*, bog-rush *Juncus* sp., sedges *Carex* spp., and horsetail *Equisetum* sp. Waterlily *Nuphar variegatum* is the only obvious submergent species.

Methods

We (LJS and KJM) surveyed the study area in a Cessna 185 airplane on 27–29 July 1986. Survey height and cruising speed were approximately 225–300 m above ground level (agl) and 250 km·h⁻¹, respectively. All water bodies within sight of the survey route were examined. When one or more Trumpeter Swans were sighted, flight speed and altitude were reduced to determine the number of adults present, the breeding status of the birds, and the number of cygnets present. More than one pass was made over the birds to confirm our observations if necessary. Survey height and cruising speed were reduced to 60 m agl and 150–165 km·h⁻¹, respectively, on the lower passes (D. Kirkhus, pers. commun.).

We surveyed the same area in a Bell 206-B helicopter on 1–2 August 1986. Cruising speed — 200 km·h⁻¹ — and survey height — 150 m agl — were reduced to 50–60 km·h⁻¹ and 30 m agl, respectively, when closer inspections were required (J. Broadbent, pers. commun.). Wetlands were tightly circled as required to facilitate observations.

Results and discussion

The survey results are presented in Table 1. The fixed-wing aircraft survey yielded 10 adults and 18 cygnets, whereas the helicopter survey revealed 17 adults and 26 cygnets — 70% more adults and 44% more cygnets than the fixed-wing aircraft survey. This study was conducted during the moult, when adults are unable to leave their breeding wetlands; as a result, migrations from one wetland to another did not influence our observations. The large difference in the results of the two surveys may be attributed to two major factors:

(1) As the minimum cruising altitude and speed of fixed-

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Table 1

Summary of Trumpeter Swan observations, July–August 1986

Site No.	Fixed-wing aircraft survey		Helicopter survey	
	Adults	Young	Adults	Young
14	2	4	2	5
14	2	4	2	5
15	2	4	2	5
15	—	—	2	0
16	2	0	2	0
16	—	—	2	0
16	—	—	1	0
20	—	—	2	4
22	2	6	2	7
Total	10	18	17	26

wing aircraft are much higher than those of helicopters, there is significantly less time to search a particular wetland or to count the number of cygnets in a brood when in a fixed-wing aircraft. These limitations are particularly critical when counting cygnets.

(2) It appears that some adult swans respond to the presence of aircraft by seeking cover in the tall emergent vegetation; despite their large size and conspicuous colour, they are surprisingly difficult to detect under such circumstances. Cygnets are even more difficult to detect: they respond to a survey aircraft by clumping into a tight group composed of the total brood and one or both adults, which makes assessment of the total brood size difficult. This problem is intensified if several passes are required to locate the family group and to assess the size and age of the brood. A helicopter allows observers to survey at a much lower height and to remain relatively stationary when counting clumped broods or birds in the vegetation, enabling more accurate counts.

Conclusion

The results of the two survey methods suggest that a significant number of swans may be overlooked when fixed-wing aircraft are used for aerial surveys. The large expanse of homogeneous landscape searched using both techniques and similar intensities of search effort limited the bias that might favour the helicopter survey. Clearly, a helicopter is the preferred aircraft for such surveys. However, helicopters cost twice as much to operate as fixed-wing aircraft, and their range is limited, which restricts their usefulness for surveys of large areas. Under these circumstances, a limited duplicate survey (as described in this paper) should be considered to enable the development of appropriate visibility correction factors.

Acknowledgements

Our appreciation is extended to Sam Barry, Larry O'Brien, Paul Gregoire, and Hugh Boyd, who provided valuable comments on the manuscript; Dean Kirkhus and Jim Broadbent, who were excellent pilots; and Susan Popowich, who prepared the figure.

References

- Caughley, G. 1974. Bias in aerial survey. *J. Wildl. Manage.* 38:921–933.
- Caughley, G.; Sinclair, R.; Scott-Kemmis, D. 1976. Experiments in aerial survey. *J. Wildl. Manage.* 40:290–300.
- Crissey, W.F. 1954. The airplane in fish and game work. N.Y. Fish. Wildl. Inf. Bull. No. 4. 20 pp.
- DeYoung, C. 1985. Accuracy of helicopter surveys of deer in south Texas. *Wildl. Soc. Bull.* 13:146–149.
- Diem, K.L.; Lu, K.H. 1960. Factors influencing waterfowl censuses in parklands, Alberta, Canada. *J. Wildl. Manage.* 24:113–133.
- Kaminski, R.M. 1979. Locating nesting waterfowl by helicopter. *Wildl. Soc. Bull.* 7:194–197.
- King, J.G. 1973. The use of small airplanes to gather swan data in Alaska. *Wildfowl* 24:15–20.
- Lotter, C.F.; Cornwell, G.W. 1969. Comparison of airplane, air-boat and helicopter for sensing Florida ducks. Pages 97–101 in *Proc. 23rd Annu. Conf. SE Assoc. Game Fish Comm.*
- Martinsen, R.K.; Kaczynski, C.F. 1974. Factors influencing waterfowl counts on aerial surveys, 1961–66. *US Fish. Wildl. Serv. Sci. Rep.* No. 109. 78 pp.
- McCormick, K.J.; Shandruk, L.J. 1986. A survey of Trumpeter Swans and their habitat in southern Mackenzie District, Northwest Territories. Unpubl. rep., Can Wildl. Serv., Yellowknife. 34 pp.
- McCormick, K.J.; Shandruk, L.J. 1987. A survey of Trumpeter Swans and their habitat in southern Mackenzie District, Northwest Territories, 1986. *Can. Wildl. Serv. Tech. Rep.* 26, Yellowknife. 44 pp.
- Ross, R.K. 1985. Helicopter vs. ground surveys of waterfowl in the boreal forest. *Wildl. Soc. Bull.* 13:153–157.
- Shandruk, L.J.; McCormick, K.J. 1988. Status of Trumpeter Swans in the southern Mackenzie District, Northwest Territories, in 1987. *Can. Wildl. Serv. Prog. Note* 177, Ottawa. 5 pp.
- Thompson, B.C.; Baker, B.C. 1981. Helicopter use by wildlife agencies in North America. *Wildl. Soc. Bull.* 9:319–323.

Figure 1
Location of aerial surveys of Trumpeter Swans, July–August 1986

